TECHNOLOGY BRIEF

November 4, 1996

Compaq Computer Corporation

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Compaq ProLiant 2500 Server Technology

EXECUTIVE SUMMARY

With the decentralization of corporations and corporate computing, departmental and remote office servers must provide a range of features that have been unavailable in traditional departmental and remote office servers. Recognizing the changing business dynamics, Compaq has developed a new business-critical departmental and remote office server that combines the latest processor, network, and storage technology in a flexible new chassis. The Compaq ProLiant 2500 Server delivers a robust set of performance, management, and availability features at a very affordable price.

This brief describes the performance, management, and availability technologies as well as the system architecture that make the ProLiant 2500 an ideal departmental and remote office server.

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Compaq ProLiant 2500 Server Technology
First Edition (November 1996)
Document Number 201A/1196

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INTRODUCTION

Many current departmental servers and remote office servers do not provide the range of features required to meet today's changing business dynamics:

- Network operating systems are becoming more robust, with more and more network services now integrated into the core operating system.
- Business-critical systems such as email and decision support systems are being pushed out into the departments and remote offices.
- Departmental servers are hosting local data linked to the enterprise. As a result, the range of capabilities required in a departmental or remote office platform have become more complex and require a more robust platform.
- MIS wants to gain control over departmental systems; however, their systems have not been robust enough to support effective management capabilities.
- Departments have become interdependent. Because so many more users will be affected if a sever goes down, availability requirements are increasing.
- Departmental and remote office locations frequently do not have qualified service and technical engineers on site to maintain and upgrade systems. With availability requirements growing, it becomes increasingly important that departmental and remote office servers be designed for easy service and upgrading.

Compaq recognizes these changes and realizes that customers need a server platform that answers the varying computing needs of specific departments and remote offices—a platform that delivers a range of performance, management, availability, and serviceability features at an affordable price.

In answer to that need, Compaq has developed a new departmental and remote office server, the Compaq ProLiant 2500 Server, which supports the following network operating systems:

- Microsoft Windows NT 3.5x and 4.x
- Netware 3.12 and 4.x
- IBM OS/2 2.x and 3.x
- SCO UNIX 5.0
- Banyan Vines 6.x
- UnixWare 2.1x

This brief explains the technology integrated with the ProLiant 2500 that makes it an ideal departmental or remote office server.

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TECHNOLOGY OVERVIEW

Compaq designed the new ProLiant 2500 specifically to meet customers' needs for a departmental or remote office server: a robust server offering high performance, availability, serviceability, manageability, and investment protection—all at an affordable price. To meet all those needs, Compaq developed a new server with a highly flexible chassis that is optimized for both tower and rack configurations (Figure 1) and a new architecture for combining the latest processor, network, and storage technology.

This section describes individual hardware features and technologies of the ProLiant 2500 server.

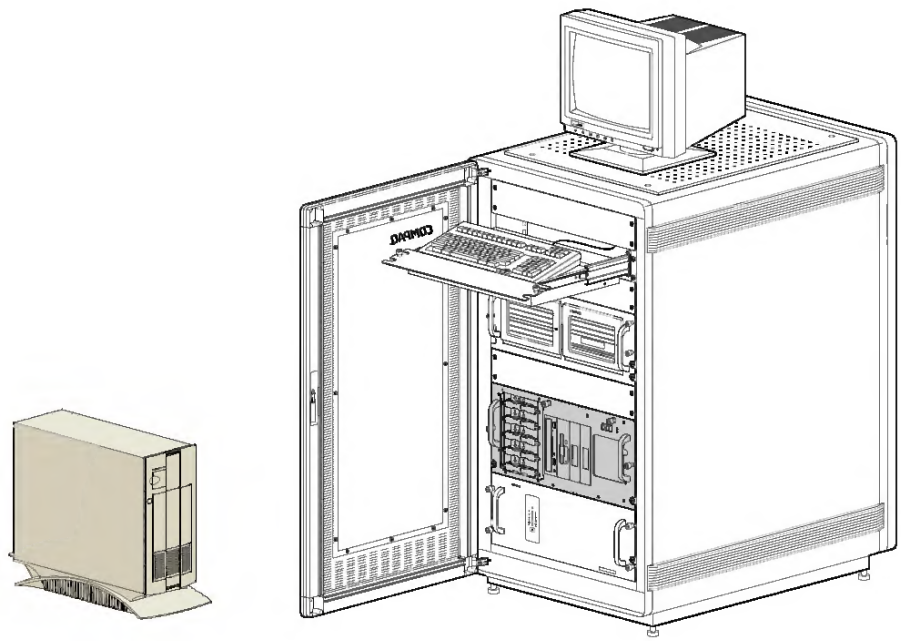

Figure 1. The Compaq ProLiant 2500 Server converts readily from a tower configuration (left) to a rack configuration (right) and back again.

Form Factor/Chassis

The ProLiant 2500 was designed using a compact, yet flexible form factor for both tower and rack configurations. This highly serviceable form factor reduces the down time associated with field upgrades and component replacement. The intent of this design is to save customers money in multiple ways:

- By standardizing on the ProLiant 2500 for departmental and remote office servers, customers can deploy and redeploy individual servers as their needs change. The ability to reconfigure a ProLiant 2500 server quickly and easily from a tower to a rack and back to a tower enclosure provides for end-of-life redeployment and protection of the hardware investment.
- The 5U chassis allows customers to stack up to eight ProLiant 2500 servers in a single 42U Compaq rack cabinet. The increased server density saves customers both space and money.
- By providing easy access to server components, the ProLiant 2500 design reduces the down time associated with upgrades and field replacement, reduces the required skill level for performing routine maintenance, and therefore reduces the cost of maintenance.

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- Standardizing on the ProLiant 2500 can reduce the overhead of maintaining an inventory of spare parts.

The flexible new ProLiant 2500 chassis was designed for maximum serviceability and provides front, rear, top, and side access for service or upgrade tasks (Figure 2). Most major chassis elements can be removed without the use of tools. Both the processor board and the I/O board are rail-mounted in lever-actuated quick release modules designed to be drawn into the chassis by a cam action lever system (Figure 3).

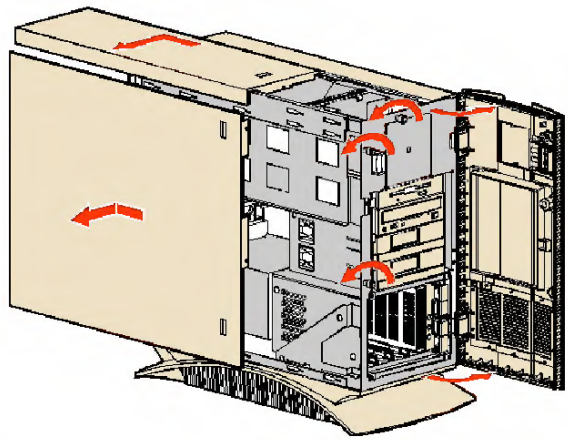

Figure 2. The ProLiant 2500 Server provides front, top, side, and rear access for service or upgrade tasks. Most major chassis elements can be removed without the use of tools.

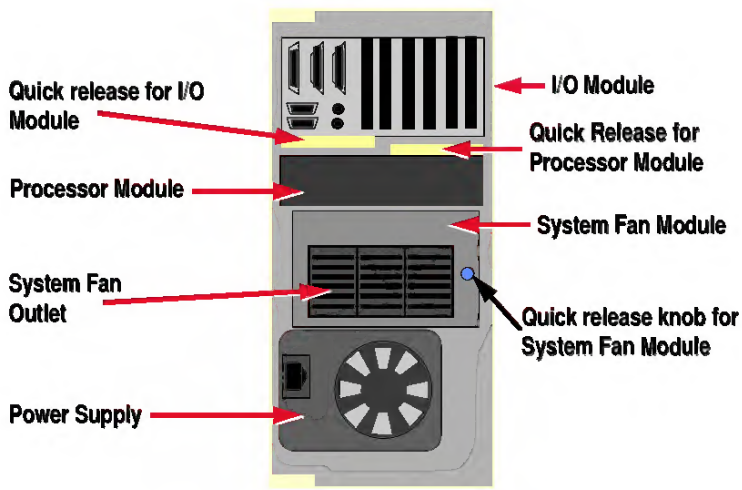

Figure 3. Rear view of the ProLiant 2500 Server chassis showing lever-actuated quick release modules.

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Adding or replacing a processor in the ProLiant 2500 simply requires opening the quick release lever, sliding out the processor board, sliding in a new processor board, and closing the quick release lever. Since main memory in the ProLiant 2500 is mounted on the processor board, adding or changing out main memory is equally simple. The slide-out processor module provides ready access to memory slots. A used DIMM (dual in-line memory module) pulls readily from its slot; and with a slight push, a new pluggable DIMM seats securely in its place.

Access to the I/O board for servicing PCI and EISA cards is also quick and tool-less. In the ProLiant 2500 tower model, access to the cards is from the top. In the rack model, access is from the side to provide equal visibility. The I/O cards slide smoothly into the expansion slots on the I/O board. A Compaq-designed rotating latch locks each card securely into place in the option card bay and also serves as a quick release for easy removal and replacement of cards (Figure 4).

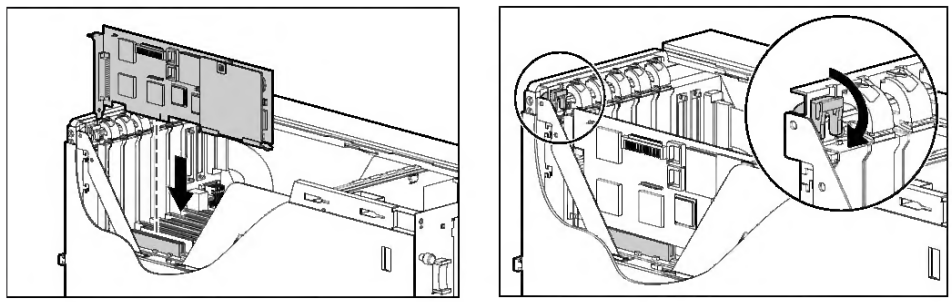

Figure 4. In a ProLiant 2500 tower model, PCI and EISA cards slide into the I/O slots from the top (left). A unique rotating latch secures each card (right).

A single quick-release knob provides easy access to the system fan, which is mounted perpendicular to the back panel and exhausts through an outlet below the fan assembly itself (see Figure 3). The power supply is mounted with four screws that can be easily removed.

With its compact 5U chassis, the ProLiant 2500 provides for improved server density in rack environments. Customers can stack up to eight ProLiant 2500 servers in a single 42U Compaq rack cabinet. By comparison, the 7U chassis of the ProLiant 1500 Server permits stacking six servers in a 42U rack cabinet. With the improved density, installation of the ProLiant 2500 becomes a one- or two-man task as opposed to a two- or three-man task; thus, the increased density saves customers both space and maintenance costs.

Security

While high serviceability requires easy access to server components, security of data and equipment is paramount. The ProLiant 2500 housing and chassis design achieves both.

In a rack configuration, access to the system is controlled by two key locks: one on the front door and a second on the rear door of the rack cabinet. In the tower model, a single key lock on the front bezel controls access to the system. The top, side, and back panels of the housing slide onto the chassis and interlock. The hinged front bezel closes over the edges of the top and side panel, securing them. A simple half turn of the key lock opens or locks the front bezel for the first line of defense against unauthorized access to the hard drives and other components (Figure 5).

The ProLiant 2500 also provides an optional, second level of security for rear-mounted components. The ProLiant 2500 comes equipped with three set screws (Figure 6) that can be used to lock the processor module, the I/O module, and the fan in place. By simply moving these screws from their initial position and placing them in the three holes shown in Figure 6, the customer can secure the rear-access modules against quick release and removal.

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The ProLiant 2500 tower model also includes a Compaq-designed security system for the server power switch. The power switch is mounted on the chassis, behind the front bezel. When the front bezel is locked into place, the power switch is accessible by means of small, sliding cover (Figure 7). To prevent someone from turning off the power to the server, this sliding switch cover can be shut and locked using a single screw on the inside of the front bezel.

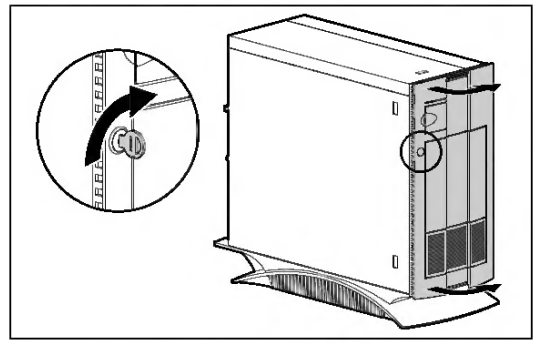

Figure 5. A key lock on the front bezel of the Compaq ProLiant 2500 Server secures data and internal components from unauthorized access.

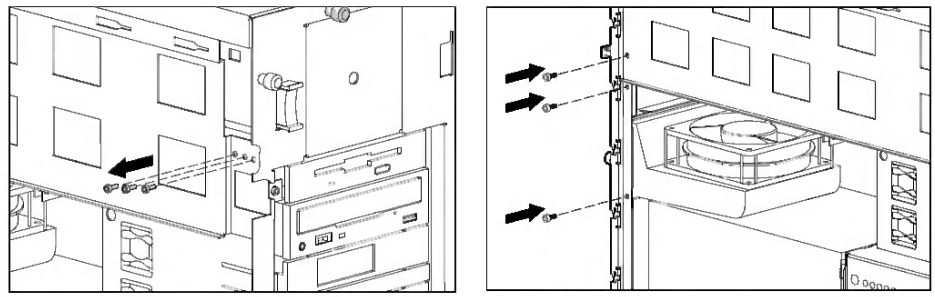

Figure 6. Three set screws mounted on the chassis under the side panel are provided for optional use to lock rear-mounted, quick release modules in place. If moved to the indicated positions, these three screws will secure the processor module, the I/O module, and the fan against quick release and removal.

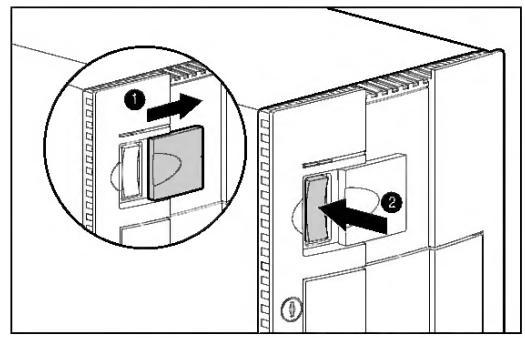

Figure 7. The sliding cover for the ProLiant 2500 power switch can be locked from the inside.

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Processors

The ProLiant 2500 uses the Intel 82440 FX chip set and is designed to support up to two Pentium Pro processors. The server comes standard with a single 200-MHz Pentium Pro processor with an integrated 16-Kbyte L1 cache (8 Kbyte for data and 8 Kbyte for instructions) and an integrated 256-Kbyte L2 cache.

The 200-MHz Pentium Pro processor provides the next-generation performance required for Microsoft Windows NT and NetWare applications. The integrated L2 cache runs at processor speed and is protected by Error Checking and Correcting (ECC) code. The L2 cache has a 4-way set-associate cache memory organization, which is an extension of the 2-way structure. In the ProLiant 2500, the total cache memory is divided into four banks (or ways) of equal size rather than two banks, and main memory is divided into logical pages equal to the size of the four banks. This structure provides four ways that data from the same physical address in main memory can be stored in cache, thereby increasing flexibility of the cache and increasing cache hit rate. In typical applications, the higher cache hit rate allows the Pentium Pro L2 cache to outperform 2-way caches that are twice as large. For specific information about ProLiant 2500 performance, refer to the Compaq performance summary titled *ProLiant 2500 TPC-C Performance*.

Intel Pentium Pro processors have precise voltage requirements; therefore, systems based on the Pentium Pro processors need to provide dedicated regulators for each processor (and for the processor support chips). The ProLiant 2500 includes a Compaq Processor Power Module for each processor. The Processor Power Module determines the precise voltage requirement of the processor and the support chip set and ensures that the proper voltage is delivered to each.

The ProLiant 2500 can be upgraded by adding a second 200-MHz Pentium Pro processor with an L2 cache of either 256 Kbytes or 512 Kbytes. The Compaq ProLiant 2500 Processor Option Kit contains both a 200-MHz Pentium Pro processor with 256-Kbyte L2 cache and the Compaq Processor Power Module needed for the upgrade. Compaq strongly recommends use of this kit to upgrade the ProLiant 2500 because Pentium Pro processors purchased from third-party vendors may not fully meet the specifications for use in the ProLiant 2500.

In the ProLiant 2500, the second processor can be configured in either of two ways:

- as an idle backup processor to increase availability, or
- as a second active processor to boost processing power as well as availability.

Customers running operating systems capable of symmetric multiprocessing (SMP) would most likely configure both processors as active. Use of an idle backup processor would be most common among customers running a non-SMP-capable Netware operating system. Compaq recommends configuring the second processor as active whenever possible to take advantage of the increased processing power.

Use of a second processor in the ProLiant 2500 increases availability by providing the means for rapid recovery in the event of a processor failure. Recovery from a processor failure in the ProLiant 2500 requires rebooting the system. If during system configuration the Automatic Recovery Server feature of the ProLiant 2500 is enabled, restarting the server after a processor failure will be automatic. If a processor fails, the server will record the failure in the Server Health Logs and attempt to reboot the system. With a successful reboot, the second processor will automatically assume the load of the failed processor.

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Memory

The ProLiant 2500 architecture is designed to use buffered Extended Data Out (EDO) RAM. The basic idea behind EDO RAM is to decrease cycle time for sequential accesses to the same RAM and in so doing, to allow for more memory bandwidth. EDO RAM has an output buffer that allows the memory chip to accept the next address while still holding the previous data result on the data bus. This concept is a refinement of Fast Page Mode (FPM) RAM and increases main memory performance, particularly for multiprocessor systems.

In preliminary TPC-C Benchmark tests conducted at Compaq labs, performance of a single-processor system with a 256-Kbyte L2 cache and 256 megabytes of EDO RAM operating under Windows NT was as much as 16 percent higher than for the same system using FPM RAM. Performance of a dual-processor processor system with a 256-Kbyte L2 cache and 256 megabytes of EDO RAM was as much as 44 percent higher than for the same system using FPM RAM. These results were obtained using the TPC-C version 3.1 Benchmark test, Microsoft Windows NT 3.51, and SQL Server 6.5.

The ProLiant 2500 comes standard with a 32-megabyte EDO DIMM in the first of four available DIMM slots on the processor board. Additional DIMMs may be installed one at a time. The slide-out processor board and pluggable memory modules make memory upgrades in the ProLiant 2500 simple.

Compaq highly recommends the use of higher bandwidth EDO memory in the ProLiant 2500 to support the increased memory bandwidth requirement of SMP operation. Compaq offers ProLiant 2500 Memory Expansion Kits containing a single 32-, 64-, 128-, or 256-megabyte buffered EDO DIMM. The system is expandable to 1 gigabyte of ECC-protected memory using the 256-megabyte buffered EDO DIMMs expected to be available in November 1996.

For the benefit of customers who plan to standardize on FPM memory to reduce their inventory of service spares or customers who have already invested heavily in FPM DIMMs, the ProLiant 2500 supports use of buffered FPM DIMMs with a 4K refresh and combinations of buffered EDO and FPM DIMMs. Compaq has available four buffered FPM memory expansion kits developed for the Compaq ProLiant 5000 Server. Because memory in the ProLiant 5000 is interleaved, each of these kits contains four buffered FPM DIMMs rather than one. As the table below indicates, the ProLiant 2500 supports use of the DIMMs from three of the four ProLiant 5000 kits.

ProLiant 5000 Memory Expansion Kits

Compaq Part No.	Total Memory	Kit Contents	Memory Refresh	Supported in ProLiant 2500
219282-001	64-MB	4 x 16-MB DIMMs	4K	yes
219283-001	128-MB	4 x 32-MB DIMMs	4K	yes
219284-001	256-MB	4 x 64-MB DIMMs	4K	yes
219285-001	512-MB	4 x 128-MB DIMMs	8K	no

Customers considering use of FPM DIMMs in the ProLiant 2500 need to be mindful that there is a performance tradeoff in doing so: FPM memory gives a memory bandwidth of 178 megabytes per second, while EDO memory gives a bandwidth of 267 megabytes per second.

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I/O

The ProLiant 2500 is optimized for PCI to support the growing I/O needs of departments and remote sites. The I/O backplane contains six PCI slots, four of which are shared PCI/EISA slots to provide backward compatibility with existing EISA controllers. Because the PCI controllers for video, network interface, and storage are integrated in the ProLiant 2500, all six expansion slots remain available for other uses.

The ProLiant 2500 contains a high-performance, integrated 10/100 TX Ethernet Network Interface Controller (NIC) on the PCI local bus for high-performance network throughput. This NIC features the Compaq/TI ThunderLAN chip set, the NetFlex-3 Network Driver Suite, and autosensing capabilities. It can accurately transfer information at either 10 megabits per second or at 100 megabits per second. The 10/100 TX Ethernet NIC automatically senses the required data speed and adjusts its transfer rate to match. Because this controller comes integrated in the ProLiant 2500, it meets customer requirements for higher bandwidth now, increases reliability, saves customers the cost of purchasing and installing a 100 Mb/s TX upgrade module later, and leaves a PCI slot open to support other network topologies such as Token Ring and 100VG-AnyLAN.

To provide cabling options, the ProLiant 2500 processor board contains both an RJ-45 and an AUI connector. The RJ-45 connector runs either at 10 megabits per second or at 100 megabits per second. The AUI connector runs at 10 megabits per second. An optional AUI-to-BNC transceiver (Compaq Part Number 192732) can be used to convert the AUI connection to a BNC connection for customers using coaxial Ethernet cable. This transceiver is provided in most international Compaq country kits.

The ProLiant 2500 contains 1 megabyte of 256K x 16, 70-nanosecond video DRAM and an integrated Cirrus Logic PCI video controller (Cirrus 54M30) that supports 256 colors at a resolution of 1024 x 768 pixels.

The ProLiant 2500 is the first Compaq server to support a hot-pluggable keyboard. This feature is advantageous for deploying the server at remote sites.

Storage

In today's networking environments the storage subsystem is a key contributor to overall server performance. In designing the ProLiant 2500, Compaq incorporated the latest Ultra SCSI technology. The ProLiant 2500 includes the new integrated Compaq Wide-Ultra SCSI Controller with the Symbios 875 controller chip as a standard feature. This PCI-based controller fully supports the SCSI and SCSI-2 devices in use today, and it is driver upgradable to support Ultra SCSI devices when they become available. This means that customers deploying ProLiant 2500 servers now will not have to invest in a new controller to support Ultra SCSI devices expected to be available in 1Q97. The Wide-Ultra SCSI Controller boosts bus speed by effectively doubling Fast-Wide SCSI transfer rates.

	Data Path	Transfer Rate
Fast-Wide SCSI	16-bit	20 MB/s
Wide-Ultra SCSI	16-bit	40 MB/s

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The level of benefit derived from Ultra SCSI depends upon two factors: the type of data reads and data block size. Seek times for non-sequential reads create bus overhead. Since each data block also creates bus overhead, the smaller the data blocks, the greater the total overhead. Consequently, Ultra SCSI controllers provide maximum benefit when transferring large data blocks accessed by sequential reads.

As illustrated in Figure 8, the new ProLiant 2500 chassis includes four drive bays for removable media:

- one dedicated to a 3.5-inch diskette drive,
- one dedicated to a CD-ROM drive connected to an EIDE controller, and
- two undedicated half-height bays.

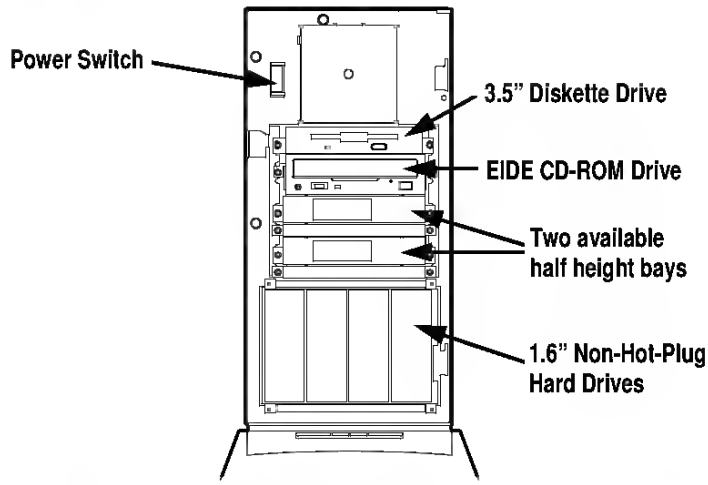

Figure 8. Front view of the Compaq ProLiant 2500 Server chassis showing four drive bays for removable media and a hard drive cage containing four 1.6-inch non-hot-plug drives.

The ProLiant 2500 contains an EIDE CD-ROM. In designing a new departmental and remote office server, Compaq elected to use the EIDE CD-ROM to leave the SCSI bus dedicated to the hard drives. Because CD-ROM drives have significantly lower utilization and data rates than server hard drives, the EIDE connection does not degrade CD-ROM drive performance.

The two available half-height bays can be used to support removable media, a full-height DLT tape backup drive, or two non-hot-plug hard drives.

The ProLiant 2500 ships standard with one SCSI bus connected point-to-point from the backplane to the disk drive cage. Since Ultra SCSI controllers transfer data at such a high speed, data integrity becomes a concern. Compaq chose a dedicated, point-to-point connection to control the integrity of the signal to and from the hard drives.

The ProLiant 2500 can support either an internal or an external array of DLT backup drives if a second SCSI controller is available. The customer can add a DLT array in one of two ways:

- by purchasing the ProLiant 2500 array model (ProLiant 2500 6/200H Model 1S, which has a second SCSI controller built in) or
- by purchasing a standard ProLiant 2500 model and installing a SCSI controller in an expansion slot.

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If the server includes a Compaq SMART Array Controller or a Compaq SMART-2 Array Controller, then the integrated Symbios 875 chip will control the DLT array while the array controller controls the hard drives. If the server does not contain a SMART or SMART-2 array controller, then the Symbios 875 chip will control the hard drives and a PCI card must be installed in an expansion slot to control the DLT array.

The ProLiant 2500 is the first Compaq product to support both the new Compaq 1-inch high-density hard drives and 1.6-inch high-density hard drives. The maximum number of hard drives that can be fitted in a ProLiant 2500 depends upon the choice of drive cage and drive height. The chassis supports drives that can be configured either as rail-mounted, cabled hard drives or as hot-plug drives mounted in drive cages.

The ProLiant 2500 hot-plug models (ProLiant 2500 6/200H) come standard without drives so that customers can select the drive trays and drives that best meet the needs of individual departments or remote offices. Hot-plug drive trays are available for 1.6-inch drives, which currently provide the maximum individual drive capacity (4.3 gigabytes), and also for the new 1-inch drives (2.1 gigabytes). In 1Q97 Compaq expects to have available 1.6-inch hard drives with an individual drive capacity of 9 gigabytes and 1-inch hard drives with an individual drive capacity of 4.3 gigabytes. Figure 9 identifies the drive cage configurations available for the ProLiant 2500.

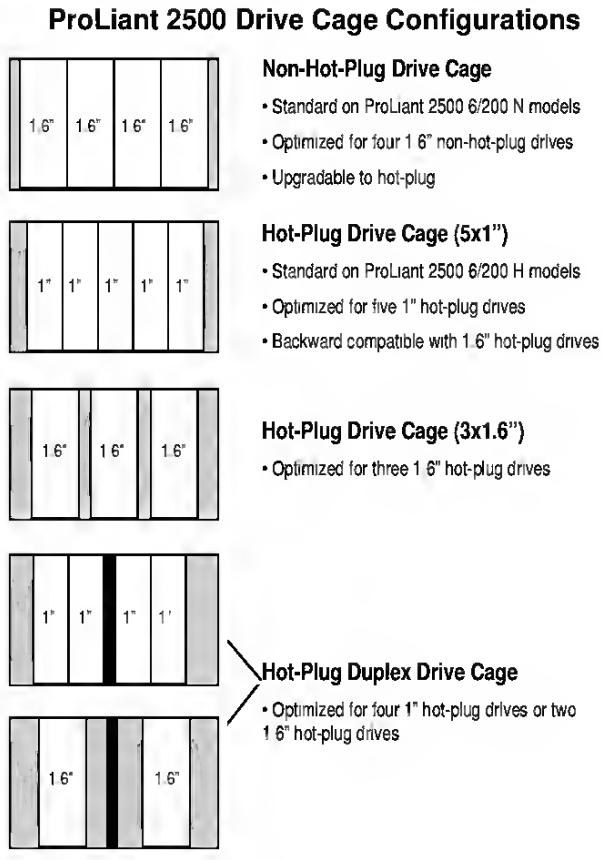

Figure 9. Available drive cage configurations for the Compaq ProLiant 2500 Server.

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The non-hot-plug model (ProLiant 2500 6/200N) comes standard with four 1.6-inch drives. It is upgradable to support hot-plug drives by replacing the standard drive cage with one of three available internal hot-plug drive cage options:

- **ProLiant 2500 Hot-Plug (5 x 1-inch) Option Kit.** A hot-plug drive cage optimized for five 1-inch hot-plug hard drives. This cage is identical to the cage used in the standard ProLiant 2500 hot-plug model (see Figure 10). It is the appropriate choice for customers standardizing on 1-inch drives to achieve higher spindle density. This cage will also support 1.6-inch hot-plug drives; it can be configured with up to two 1.6-inch hot-plug drives plus one 1-inch hot-plug drive.
- **ProLiant 2500 Hot-Plug (3 x 1.6-inch) Option Kit.** A hot-plug drive cage optimized for three 1.6-inch hot-plug hard drives. This is the appropriate choice for customers standardizing on 1.6-inch drives to achieve maximum drive capacity.
- **ProLiant 2500 Duplex Option Kit.** A hot-plug drive cage designed for customers who want to operate in duplex mode. The duplex option supports drive mirroring for increased availability. It requires that a second SCSI bus be installed to provide redundancy of controller and drives. The cage in this kit contains a duplexed SCSI backplane and is optimized for four 1-inch or two 1.6-inch hot-plug hard drives.

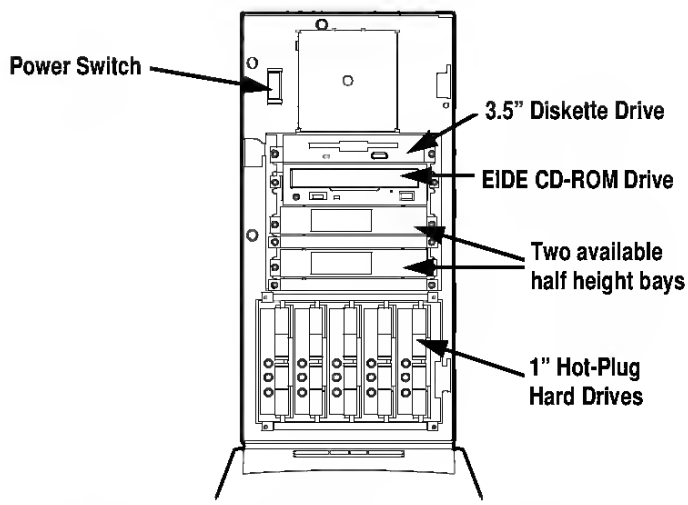

Figure 10. Front view of the Compaq ProLiant 2500 Server chassis showing four removable media bays and a hard drive cage containing five 1-inch hot-plug drives.

The ProLiant 2500 also supports the Compaq ProLiant Storage System for customers needing even greater storage capacity. In fact, the combination of a non-hot-plug ProLiant 2500 server and a ProLiant Storage System can provide up to 63 gigabytes of storage for a low total system cost.

Operating the ProLiant 2500 Server in hot-plug duplex mode requires the installation of a Hot-Plug Duplex Option Kit. Customers who know at the outset that they will be using hot-plug drives in duplex mode are advised to purchase the ProLiant 2500 non-hot-plug model (ProLiant 2500 6/200N) and the Hot-Plug Duplex Option Kit. Compaq makes this recommendation because the cost difference between the standard hot-plug model and the non-hot-plug model equals the cost of the Hot-Plug Duplex Option Kit.

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The ProLiant 2500 also supports use of a 1.6-inch non-hot-plug drive in each of two available half-height removable media bays shown in Figures 8 and 10. This capability allows the customer to create additional primary storage. It also allows a customer to increase availability by using the hot-plug drives for storing data in a RAID (redundant array of inexpensive disks) configuration and using non-hot-plug drives in the two half-height bays for mirroring the operating system. With such a configuration, if the active OS drive should fail, the system could quickly be reconfigured to boot the OS from the mirrored drive. If a data drive should fail, RAID would automatically rebuild any lost data.

Power

The ProLiant 2500 contains a 325-watt power supply that provides nominal output of +3.3 V, +5 V, +12 V, -5 V, and -12 V. The trend today is toward use of lower-voltage components. System memory in the ProLiant 2500, for example, operates at 3.3 V. In 1Q97 Compaq expects to have available a redundant power supply for the ProLiant 2500. This non-hot-pluggable option will provide two power supply modules within a single housing and will support two AC inlets.

Intel Pentium Pro processors have precise voltage requirements; therefore, Pentium Pro-based systems need to provide dedicated voltage regulators for each processor (and for the processor support chips). The ProLiant 2500 includes a Compaq Processor Power Module for each processor. The Processor Power Module determines the precise voltage requirement of the processor and the support chip set. Then it ensures that the proper voltage is delivered to each component.

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PROLIANT 2500 SYSTEM ARCHITECTURE

The overall goal of Compaq multiprocessing architecture is to maximize system throughput by allowing each critical server subsystem (processor, memory, and I/O) to operate as fast as reliably possible. Compaq chose to optimize the ProLiant 2500 for PCI, the new industry standard for I/O, while maintaining backward compatibility with EISA peripherals customers have previously purchased. Each subsystem in the ProLiant 2500 is individually optimized using separate, high-bandwidth buses.

The ProLiant 2500 Pentium Pro system features a Gunning Transceiver Logic (GTL+) processor bus (referred to in this brief as the host bus) that supports high-speed, low voltage transfers. It is a 64-bit split-transaction bus operating at 66 MHz with a throughput capacity of 267 megabytes per second. Data integrity is ECC protected.

Figure 11 is a block diagram showing the PCI-to-PCI bridge architecture used in the ProLiant 2500. This primary bus expansion scheme is an economical choice for departmental servers and provides extra PCI slots for additional PCI devices. This expansion scheme supports one primary PCI bus directly and independently linked to the high speed Pentium Pro processor bus via a host-to-PCI bridge. A secondary PCI bus with the same 133 megabytes-per-second transfer rate is bridged off the primary bus. For backward compatibility, the ProLiant 2500 architecture includes an EISA bus also bridged off the Primary PCI bus. This EISA bus has a data transfer rate of 33 megabytes per second.

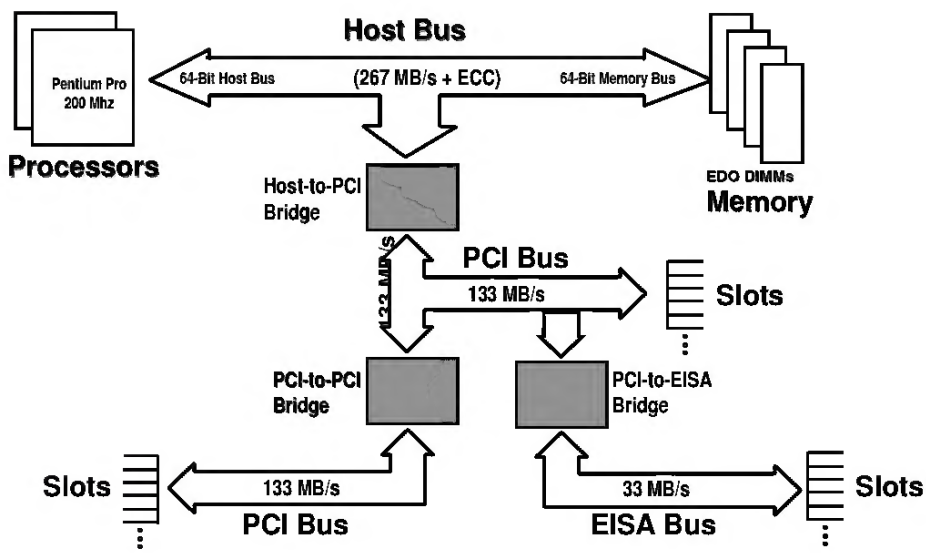

Figure 11. Block diagram showing the PCI-to-PCI bridge architecture used in the Compaq ProLiant 2500 Server.

Figure 12 also depicts the I/O buses (primary and secondary PCI buses and EISA bus) and expansion slots in the ProLiant 2500. The primary PCI bus supports the following:

- PCI on dedicated slots 5 and 6 and on shared slot 4
- EISA bridge
- Integrated Remote Console (IRC)

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The secondary bus supports the following:

- PCI on shared slots 1, 2, and 3
- Video controller
- NIC
- Embedded PCI Wide-Ultra SCSI Controller

The EISA bus supports EISA on shared slots 1, 2, 3, and 4.

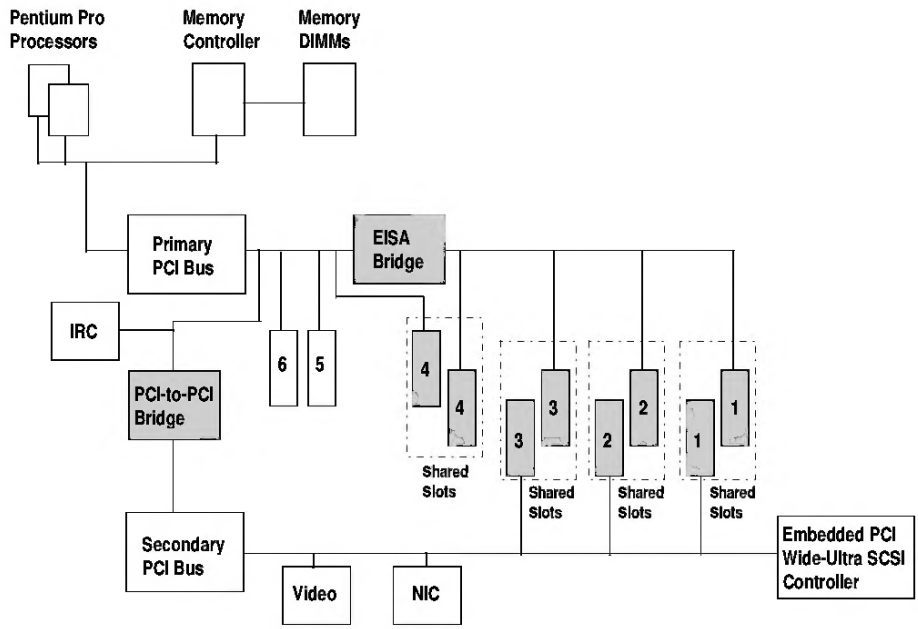

Figure 12. I/O Architecture of the Compaq ProLiant 2500 Server.

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PRICE:PERFORMANCE OF THE PROLIANT 2500 SERVER

The ProLiant 2500 includes a combination of architecture and hardware features that delivers a level of performance similar to that of the Compaq ProLiant 4500 Server at an affordable price for departmental and remote office servers. Recent test results discussed below confirm that the ProLiant 2500 outperforms other servers in its class.

TPC-C Benchmark

The Compaq ProLiant 2500 6/200 was recently performance tested using the TPC-C version 3.2 Benchmark test. The TPC-C Benchmark is an on-line transaction processing (OLTP) workload benchmark developed by the Transaction Processing Performance Council (TPC). This benchmark test simulates the demanding operations processed in complex OLTP application environments. The test was performed using Microsoft Windows NT 4.0 and SQL Server 6.5. The results were audited by an independent company.

The ProLiant 2500 6/200 with dual processors delivered performance of 3594.47 tpmC at a cost of only $82.21—significantly higher performance than leading competitors have demonstrated in published TPC-C results to date and almost triple the performance of the Compaq ProLiant 1500 5/166 Server. For details of this TPC-C test, refer to the Compaq performance summary titled *ProLiant 2500 TPC-C Performance.*

AIM Server Benchmark

On October 9, 1996, at the UNIX EXPO Plus, AIM Technology announced the winners of its 1996 Hot Iron Awards for systems achieving the best performance while operating under Windows NT or under UNIX. The awards were based upon results of tests with the AIM Server Benchmark and AIM Subsystem Benchmark.

The ProLiant 2500 6/200 with dual processors was recognized in the following categories for servers costing less than $25,000:

Operating System	Category	Award
Windows NT	File Server MIX	Best Throughput Performance
UNIX	Multi-User Shared System MIX	Best Throughput Performance
UNIX	File Server MIX	Best Throughput Performance
UNIX	File Server MIX	Best Price:Performance Throughput

SYSTEM MANAGEABILITY

Typical departments and remote offices have limited personnel and budget for system and network administration. The decentralization of applications and the need to interconnect a growing number of users stretch administration resources and demand cost-effective server management and maintenance.

The ProLiant 2500 includes a full complement of server management features:

- Automatic Server Recovery (ASR-2)
- Fan spin sense
- Internal temperature sense
- Performance monitoring

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- Compaq Insight Manager CD
- Integrated Remote Console (IRC)
- Support for an optional Compaq Remote Insight Board

The new Compaq Integrated Remote Console, which provides seamless remote console for managing remote office servers, is being implemented for the first time in the ProLiant 2500. IRC is a Compaq-designed ASIC (Application Specific Integrated Circuit) that provides hardware-based server management abilities to augment the existing software-based management capabilities in Compaq Insight Manager. Because IRC comes standard and is integrated in the ProLiant 2500, it significantly raises the level of remote server management capabilities of this server. To enable IRC, the managed server must simply have a suitable serial communications device: an internal modem, external modem, or a dedicated serial cable.

For more information about IRC, refer to the Compaq technology brief titled *Remote Server Management with Integrated Remote Console.*

To further enhance system manageability and reduce maintenance costs, Compaq provides the Compaq Pre-Failure Warranty with the ProLiant 2500. This extended warranty enables system administrators to identify critical components in danger of failing and to replace them free of charge before an actual failure brings the system down.

Under the Compaq Pre-Failure Warranty, hard drives, memory modules, and Pentium Pro processor(s) in a ProLiant 2500 server are eligible for free replacement during the standard product warranty period, if the system determines that one of these components has degraded below predetermined reliability thresholds. This allows system administrators to obtain replacement parts and schedule the required maintenance at a convenient time.

CONCLUSION

Compaq designed the ProLiant 2500 Server to meet the specific needs of departmental and remote office computing today and into the future. The ProLiant 2500 offers next generation performance, high availability features, and investment protection—all at an affordable price. The sleek new chassis design provides flexible upgrade and redeployment paths, improved serviceability with reduced maintenance costs, and a 5U form factor for increased server density in a rack environment. System manageability features such as Integrated Remote Console and the Compaq Pre-Failure Warranty Program enable system administrators to manage and maintain ProLiant 2500 servers proactively and cost-effectively from a central location. This unique combination of features makes the ProLiant 2500 an ideal departmental or remote office server.

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